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NAME OF AUTHOR: BRIAN L. MILES

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MODALITY PREFERENCE AND REPRESENTATIONAL SYSTEMS

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MODALITY PREFERENCE AND REPRESENTATIONAL SYSTEMS

BY

BRIAN L. MILES

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND

RESEARCH IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF MASTERS OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled MODALITY PREFERENCE AND REPRESENTATIONAL SYSTEMS submitted by BRIAN L. MILES in partial fulfillment of the requirements for the degree of MASTER OF EDUCATION.

ABSTRACT

The present investigation was designed to provide evidence that modalities are a functional construct for use in modeling psychological or educational differences between individuals. The purpose of this investigation was fourfold: (1) to examine the feasibility of testing preferred modalities, (2) to examine the relationship between different modality testing techniques, (3), to examine the background of groups with similar preferred modalities, and (4) to examine the preferred modalities of groups with similar backgrounds.

Modalities were operationally defined by scores obtained on a battery of four measures; the Visualizer-Verbalizer Quiz, the Modality Index, the Questionnaire on Vividness of Mental Imagery and the Representational System Bias Test. These instruments were designed to examine memory of imagery-based words, performance of modality oriented tasks, response to questions on vividness of mental imagery and preference of predicate for sentence completion. The three modalities tested were visual, auditory, and kinesthetic.

Undergraduate students in the Faculty of Education at the University of Alberta served as subjects for this study. The total number was 97,which included 73 females and 24 males.

The results of the four tests grouped by subtest of

modality, were examined for correlation using the Pearson's Product Moment. The results revealed that the tests were uncorrelated at the .05 level for any of 18 possible correlations between tests.

The three modality groupings were further examined using Varimax factor rotation to confirm any relationships in the data. The individual tests were also examined using Varimax factor rotation and calculation of Alpha reliability coefficients.

The results of the additional analysis indicated the Verbalizer- Visualizer Quiz and the Representational System Bias Test had low reliability and no factor loadings on the basis of modality.

The results further indicated that the Modality Index and the Questionnaire on Vividness of Mental Imagery showed reliabilities in excess of 0.60 and subtests which factored on the basis of modality. However these tests produced different factors for each modality, indicating different constructs which could not support each other as a combined test.

The research implications were discussed in terms of modalities as a functional construct for defining educational or psychological needs.

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CHAPTER I

INTRODUCTION

The conscious mind of humankind, its form and function, have been discussed since the time of the Greeks when Aristotle classified thought as either "active or passive reason" and was convinced that the soul never thinks without a picture (Aristotle; Winelband, 1958). At about the same time Epictetus observed that "men are not disturbed by things, but by the views they take of them" (Epictetus; Winelband, 1958). Even in Ancient Greece, consciousness was being defined in terms of a dual mind, with imagery capability and a predisposition to see things with a view which had a personal slant. The nature of this inner life, which people experience when thinking or learning, is today the basis of our theories of psychology and learning, whether or not it is specifically spelled out in a philosophical statement.

The 'mechanisms' of the mind implicit in any theory are often unexplained. A physical action is assumed to be the product of processes within the mind and this action is accepted as a demonstration of the theory, or an internal process is simply theorized to be part of the mind independent of any empirical evidence. The lack of empirical evidence and the requirement for assumptions about the function and form of consciousness is a difficulty which all students of psychology or philosophy will have

to deal with if they are to understand their own nature and the nature of being human.

The simplicity of a direct relation between thought and learning in the experiencing of the external world were noted by Sir Francis Galton during the 1870's when he ran his "anthropometric" laboratory and devised the first tests of the "mind" of man. Galton (1883) stated "the only information that reaches us concerning outward events appears to pass through the avenue of our senses; and the more perceptive the senses are of differences, the larger is the field upon which our judgement and intelligence can act..." (p. 27). Galton's major interest in the sensorimotor abilities of man translated to test techniques in which he chose to test the function of man's mind with relationship to the body senses. A number of tests devised by Galton assumed that the mind had the equivalent abilities of the body senses and could with varying degrees of proficiency "image", replicate, or remember in terms of the senses, as his breakfast table questionnaire illustrated. The questionnaire was designed as a self assessed measure of mental imagery using visual, auditory, and kinesthetic memory of the breakfast eaten that morning.

Betts (1972) in his 1909 study of imagery, produced a questionnaire which is still used in the present day. It requires the rating of seven different forms of imagery on a seven point Likert scale. Images were identified as visual, auditory, cutaneous (feeling), kinesthetic (body

movement), gustatory, olfactory and organic (body sensation). In his introduction, Betts identifies the existence of studies involving the process of "...reading to subjects a paragraph calculated to suggest visual and auditory images, then asking the subjects to write down in their own words what they remembered of it, and to compute the percentages of visual and auditory images employed. Betts also identifies a study of consonants used by Browning, Shelly, Tennyson and others, and the inferred types of mental imagery. Betts concluded that Tennyson seemed to pay particular attention to the mental imagery of the five senses that his poems would excite (Betts, 1909). At the time of Betts' research, the relationship between language, mental imagery and modalities was only assumed to exist; Betts' study addressed virtually all issues with which the current study is forced to deal.

During the past decade the concept of modality has increasingly appeared in literature on learning and psychology. Modalities are assumed to be a mental image or representation in consciousness of an equivalent external experience from one or more of the five senses. It is also assumed that there is a functional or preferential difference between the ability to mentally image any one or all of the senses, and these differences account for some variance in learning and psychology of individuals.

In recent years there have been two major endeavors to incorporate modalities into educational or psychological

theories. Swassing and Barbe, (See Appendix) have produced a 'modality index' which is currently being used as a deficiency test of students requiring remedial teaching. Swassing and Barbe argue that differential abilities or preference based on modalities dictate the greater portion of an individual's learning success; furthermore, it is believed that emphasizing education in preferred modalities will overcome students' problems. Bandler-Grinder (1975) used the concept of modality to explain individual differences and disfunctions in their Neuro Linguistic Programming model of personal psychology. They argued that the major component of psychological problems or limitations are incomplete, confused, or misinterpreted sensory memories which creates problems in responding usefully to current happenings.

In both cases the assumption is that a person will have a developed or an existing preference for one modality which will at some point limit or direct consciousness in such a manner as to constitute a problem or advantage in any given situation. Despite the attention Swassing-Barbe's Modality Index has received in the area of educational testing and the successful intervention techniques developed by Bandler-Grinder, there is little empirical research to verify or reject the hypotheses and assumptions implicit in using the construct of modalities as part of a model of mental functioning.

The present study attempts to examine one facet of mental functioning, that being the use of mental imagery of a sensory nature: visual, auditory and kinesthetic. The findings will be related to current theories of human mental function and language. Stated explicitly, the purpose of this study is to attempt to answer the following questions:

(1) What methods might be used to test mental functioning for an orientation to a preferred form of mental imagery, specifically visual, auditory, and kinesthetic modality?

(2) Is there a relationship between modality-based mental imagery and past experience?

(3) Is there a relationship between modality-based mental imagery and current abilities?

Definitions

Modality in this study was defined as any channel through which an individual receives and retains information. This was considered to imply sensation, perception, and memory and was limited to the modalities of visual, auditory, and kinesthetic. Kinesthetic modality was considered to be a composite ability including muscle movement, sense of touch, and emotional content.

Modality preference was considered to be any indication that a person was consciously or unconsciously demonstrating superior ability to function in one modality.

World view is considered to be the beliefs about ourselves, others, and the world around us which filters our perceptions of reality.

Mental imagery is assumed to include all internal awareness of images invoked in consciousness from memory or emotional affect, and excludes perception of current external happenings.

Metaphor and metaphoric language were considered to be limited to the forms used in normal conversation and resulted from previous learnings or existing psychological function.

CHAPTER II

THEORY AND RELATED LITERATURE

Introduction

In order to answer the questions posed in the introduction of this thesis, the theorized relationships between consciousness, belief systems, mental imagery, language, metaphor and modalities will be discussed. To account for the relationships assumed in the course of this study, the relevant theory and literature will be discussed under the following subheadings: Methodology and consciouness, Dual mind and consciousness, consciousness and belief systems, belief systems and mental imagery, mental imagery and language, language and metaphor, metaphor and modalities.

Methodology and consciousness

Merleau-Ponty (1962) expressed the following view: that: "The whole universe of science is built upon the world as directly experienced, and if we want to subject science itself to rigorous scrutiny and arrive at a precise assessment of its meaning and scope, we must begin by reawakening the basic experience of the world of which science is the second-order expression." (p.54). As part of this view goes the claim, often particularly emphasized, that consciousness of the world cannot be explained by natural science in terms of effects efficiently caused in

consciousness by things outside. Freedom of action and belief is contradicted by the concept that we are controlled by outer events, since freely formed correct beliefs about the efficient causes would be an illusion.

Ponty's comments point directly to a need to find methods of contacting as directly as possible the human experience involved in our theorizing. In the case of consciousness, this requires forming a methodology which will demonstrate to some degree any theoretical connections which we wish to postulate. In addition we are likely unable to use external stimulus as means of fully explaining human behavior as it contains the contradiction of externally motivated people studying their internal motivations. It is in this vein that we assume the "free will' to explore the limitation of clients and students to better understand the nature of the illusions or limitations to which we are subject.

The requirements of empirical science are difficult to meet when dealing with happenings within the mind. The natural scientific approach is based on three main assumptions: (a) the object of study must be observable; (b) the object of study must be measurable; and (c) more than one person must be able to observe and agree upon the object's identity and characteristics (Valle & King, 1978). Any study of the function and abilities of the mind brings together a number of problematic topics in the realm of empirical science. This study must deal with the

nature of consciousness, belief systems, mental imagery, language and metaphoric language, within the limitations of natural science.

Natsoulas (1970) agreed that:

> ... empirical science proceeds on the basis of observation and these observations must be the product of commonly accepted methods; however within the behavioristic field there is little that can indicate and record the nature of a subject's thoughts. At this time there is an increasing acceptance of experiential reporting, which is accompanied by acceptance that reports of inner experience are subject to limitations imposed by attention, selection, categorization, memory, and communication (p.94).

There are roughly five classes of procedures currently in use for obtaining systematic reports of inner experience. First there are questionnaires to be filled out retrospectively. Second, participants may be asked to think out loud, reporting the verbal elements in their consciousness as they occur. Third, participants may be asked to engage in some form of task or to go about their daily living, during which they are interupted periodically and asked to describe the inner events they recall occurring just before the interruption. Fourth, in a consciousness-sampling procedure like the foregoing, they might be asked to rate their inner experience on a previously agreed-upon scale. Fifth, people can be asked to

report particular events each time they occurred during a time interval (Klinger,1978).

The last four methods mentioned by Klinger have basically the same problem: they are difficult to operationalize on a group testing basis. The reports obtained from participants are largely individual reports which are difficult to compare as the events being reported are part of the individual's personal history at the time of reporting and will vary from person to person. The methodology of reporting retrospectively on questionnaires has the greatest potential for eliciting memories or thoughts about common experiences which would allow comparisons between individual reports.

Questionnaires to study inner experience have been used at least since Galton (1883) devised one to assess the quality of people's imagery. One early questionnaire, the Betts Questionnaire on Vividness of Mental Imagery (Betts, 1909)(See Appendix) is still in use and has been joined by others, the Gorden Test of Visual Imagery Control (Gorden 1949), the Singer-Antrobuss Imaginal Process Inventory (Singer and Antrobus, 1963) and the Richardson Verbalizer-Visualizer Quiz (Richardson, 1977)(See Appendix). Each of these questionnaires endeavors to have people rate their internal abilities to image everyday thoughts and memories. The indications are that methods of exploring the "inner" life exist if we are willing to accept that the rigorous definition for proof in empirical science

will allow subjective reporting.

Dual mind and consciousness

In theorizing about the form and function of the mind, the behaviorist view identifies an explicit or implicit division into a two-class system: the stimulus-bound, respondent, directed conscious thought is one division, and stimulus-independent, operative, daydreaming or fantasy is the other division (Klinger, 1978). This two class system has many precursors: Active versus passive reasoning (Aristotle; Windelband 1958), secondary versus primary process thinking (Freud, 1900/1961), thought with or without 'designe' (Hobbes, 1651/1958), conscious versus foreconscious or affective thought (Varedonck, 1921), R-thinking versus A-thinking (Mckellar, 1957). realistic versus impulsive thinking (Hilgard, 1962), and directed versus autistic thinking (Berlyne, 1965). The two mind sets suggested by these writers seem to be different forms of consciousness. Classifying only two forms of thought could be considered an oversimplification were it not possible to demonstrate their existence on a physiological basis.

The research on left-right brain hemispherical function indicates that man is physiologically dual minded, with fully functional and qualitatively different capabilities in each half of his brain. Sagan (1979) argues that the original works of Broca and his discovery of the relationship between language and the left side of the

brain have had the greatest influence on the current research on the dual brain concepts. Initially the great importance of language and the dominance of the right hand, also controlled by the left hemisphere, led to the conclusion that the left hemisphere was more important then the right. The left was therefore considered the dominant hemisphere and resulted in an acceptance that this mode of operation was in some way superior. Jackson (1958) however, challenges this view of hemispheres:

> The leading hemisphere for speech might not be the leading hemisphere for all functions, but the so-called minor or right hemisphere might be leading for some functions. If the faculty of expression resides in one hemisphere, there is no absurdity in raising the question as to whether perception - its corresponding opposite - may not reside in the other." (p.43)

In the 1970's, some advances were made in spelling out the functional differences between the hemispheres. There is evidence of left hemisphere superiority in tasks involving grammatically organized word sequences, mathematics, analysis, logic, sequences over time and motor coordination. Right hemisphere functioning seems dominant in tasks involving imagery, certain visual and constructive activities such as drawing, copying, assembling block designs, perception and manipulating of spatial relations of and between objects or configurations, and the simultaneous grasping of fragments or particulars

as a meaningful whole (Dimond and Beaumont, 1974; Kinesbourne and Smith, 1974; Ehri and Muzio, 1974; Nebes, 1974; Singer , 1974; Hellige, 1975; Oltman et al., 1976). The parasympathetic and sympathetic systems along with other biochemical, autonomic, hormonal and subcortinal functions have been functionally associated with the right and left hemispherical systems. Baken (1976) summarized these two modes of thought:

> The left hemisphere mode is described as symbolic, abstract, linear, rational, focal, conceptual, propositional, secondary process, digital, logical, active and analytical. The right hemisphere mode is described as iconic, concrete, diffuse, perceptual, appositional, primary process, analogue, passive, and holistic. The two modes are antagonistic and complementary, suggesting that a unity and struggle of opposites is characteristic of mental functioning.(p.34)

The words 'struggle of opposites' may be overstated, but certainly we must consider the possibility that thought is directed by different sides of the brain under different circumstances, or interact to produce a combined effect. If two modes of thought are mediated respectively by the right and left cerebral hemispheres, then it becomes meaningful to ask whether individuals differ in the degree to which they rely on one or the other hemispheres in their overall psychological functioning. A bias toward greater reliance on one hemisphere, be it right or left, could

significantly influence the quality of consciousness. Individual differences and the behavior based on the quality of consciousness, may be due to the different biases toward the use of one of the hemispheres. The present study will endeavor to explore a facet of dual consciousness related to the interaction between the two minds and the manner in which this interaction would be manifest.

The two forms of consciousness and their differences can easily be summarized as being between the objective, empirical scientific mind and the subjective, affective artistic mind. These two forms of consciousness are described by Johnson (1986):

> The left brain apparently, functions to analyze the world rationally, allowing the wonderful power over the physical universe which we have achieved. This brain leads us to think about the world and act within it in certain ways, unfortunately to the exclusion of others which might be equally interesting and challenging.(pg.14)

> What about the alternate consciousness deriving from the right brain. This brain knows through 'intuition', feels satisfaction not through sensory experience as much as by sensing a-rationally what the underlying wholeness of life is. (pg.15)

These two mind 'sets' represent the requirement for scientific proof of the nature of consciousness on one hand and on the other hand, the subjective acceptance of self as

demonstration of consciousness with no proof required. To fully appreciate a definition of consciousness we must resolve the dichotomy of requiring some demonstratable evidence of mind and function for scientific 'left brain' purposes and our 'right brain' acceptance of personal experience and knowledge that constitutes our self awareness. Klinger (1978) sums up these concepts of thought:

> ... most of the thought which could be classified as respondent or stimulus-dependent is rather humdrum. "Fantasy," it appears need not be fanciful. Going still further, it appears that both directed and undirected thought may be more or less subject to certain types of dreamlike errors or "fusions". Finally, there appears to be a dimension of ego relationships to one's imagery that cuts across the other. The upshot of these considerations is that we must complicate our taxonomy of thought.(p.34)

The 'duality of mind' does not explain enough of the happenings in consciousness; we will have to explore further and elaborate on the nature of the interactions between the minds. To do this we will have to develop a methodology which can demonstrate a continuum of combinations and interactions between the polarites of these states of consciousness.

Consciousness and belief systems

The accumulative effect of our beliefs, attitudes,

perceptions, interpretations, expectations, and understandings are referred to as a personal construct system (Kelly, 1955), a lifestyle (Adler, 1965), a perceptual field (Combs, Richards and Richards, (1976), a representation or model of the world (Bandler and Grinder, 1975) and as a world image (Watzlawick, 1978). Regardless of what it is called, this 'view' of the world is a complicated creation. Watzlawick (1978) refers to this world view as "the most complex synthesis of the myriads of experiences, convictions, and influences, of their interpretations, of the resulting ascription of value and meaning which an individual can muster" (p. 43).

It is these belief systems or views which are the manifestation of the interaction between the polarities of consciousness. A number of schools of psychology assume that the manner in which people think, feel, and act is on the basis of these perceptions and interpretations of reality, not on the basis of 'objective' reality. These psychologists claim that as we live and experience, we construct a set of beliefs about ourselves, others, and the world around us, and this 'personal theory of reality' acts as a lens or filter which screens our perceptions of reality, and thus influences our thoughts, feelings, and actions.

A number of schools of counseling identify the need to understand the experiential and emotional world of a client and necessity to gain an understanding of that client's personal view of the world. This orientation

applies in particular to the phenomenologically oriented schools of counseling which emphasize the importance of the effects of world-view, such as Rational-Emotive Therapy, Transactional Analysis, Gestalt Therapy, Adlerian or Individual Psychotherapy, Cognitive-Behavior Therapy, Neuro Linguistic Programming. Gordon (1978) summed up the view of these therapies:

> A primary focus of therapy has always been the attempt of the therapist to understand the client's model of the world. Towards this end the therapist asks the client to describe in detail his experiences regarding the problem under discussion. The underlying assumption is that if the therapist is going to help the client change, the therapist must first understand how the client presently hears, sees , and grasps the world. (p.11)

Gordon used the words hear, see, and grasp which bear directly on the question of a 'world-view' which by its wording seems to be entirely visual, when in fact it is might more properly be called a 'world-sense'. 'World sense' would more correctly encompass all modalities which might be involved; however we most often refer to our 'view point' or 'world-view'.

This 'world view' is also individually unique. While some aspects of peoples 'world view' will be similar, due to the common shared experiences of living in the same culture, other peoples 'views' may differ radically because of the differences in their individual experiences, their

interpretations and reactions to them. Because no two people share exactly the same life experience, each person's 'view' of the world, their telling of their history, or how they feel about the experience will be totally unique.

It is important that the counselor gain a clear understanding of clients, their perceptions and feelings about the experiences which brought them to seek help. In education the challenge is to connect to the manner in which students come to understand and represent the learnings for themselves. Client/student must somehow explain to the counselor/teacher who they are, the nature of their experience, and the particular characteristics of a problem from their 'viewpoint' of the world. The communication of subject matter, which is problematic within a client/student world-view, has to be a highly subjective, emotional, individualistic interpretation of the experience in question. Any discussion of world-view will be complicated by a limited ability or knowledge on the part of the client/student and the difficulties of communicating with a counselor/teacher who has a different 'view' of the problem. Indeed if the 'view' of the counselor/teacher were the same as the client/student it would almost be, by definition, a problem for both of them, as they would both have the same 'view' of the matter and both would see it as a problem.

It is understandable why communicating one's

world-view to others would be a difficult task. Most people are unaware they have a personal viewpoint which is focusing or filtering their perceptions and reactions to events. People who might be aware of having a 'world-view' are often unsure of their own personal variation. Even people with a reasonable understanding of their viewpoint will often have a difficulty expressing its complexity and abstractness, and can be confounded by their awareness of focusing and filtering of thought and feelings about the subject of their 'world view'.

The exploration of this 'view' requires the reporting of one's inner experiences and the flow of consciousness, but we must question "exactly what is being reported on?" Klinger (1978) suggested:

> The events in consciousness are, of course extremely complex and varied, embracing images in every sensory modality, with every degree of vividness, realism, believability, including inner dialog, hallucinations, reveries, and dreamlike sequences and most pervasive, the emotional affects.(p.54)

The imagery of the mind has to become a major component in the understanding of the consciousness and the nature of the directing and focusing which would be taking place in any view of the world.

Belief systems and mental imagery

Any discussion of mental images must deal with the

fact that they are not at all like physical images - paintings, photographs, records or tape recordings. Schwartz (1981) stated:

> Images cannot be readily located in physical space and cannot, in the ordinary sense of the words, be touched, heard, smelled or seen. While visual imagery tends to hold center stage in imagery research, it is usually admitted the phenomena are not limited to just this modality. We may have auditory, gustatory, and kinesthetic images as well. (p.110).

Dennet (1981) pointed out "the concept of a mental image must always be hedged in a variety of ways: mental images are in a different space, do not have dimensions, are subjective, are intentional, or even, in the end, just quasi-images." He offered an acid test for images

> An image is a representation of something, but what sets it aside from other representations is that an image represents something else always in virtue of having at least one quality or characteristic of shape, form or color in common with what it represents. Images can be in two or three dimensions, can be manufactured or natural, permanent or fleeting, but they must resemble what they represent and not merely represent it by playing a role - symbolic, conventional or functional- in some system. (p.53)

According to this definition, the reflection of the moon on the water has no properties as an image until there is a person to see and recognize these properties. A television

camera providing an image to a car engine so it can 'see where it is going" has no perceiver and as a result no functional image. The image therefore might best be considered an element in perception and consciousness which functions as raw material, having the property of eliciting response, rather than being an end product elicited from perceptual processes.

Dealing with mental imagery is less a problem of disbelief and more a problem of the significance of the imagery. Data gathered on imagery in the last century have not convinced everyone of their importance. It has instead spawned a whole new generation of critics who are sure the 'imagists' explanations of cognition are without merit. However critics generally do not deny that people experience images; rather they deny the significance of these phenomena for psychological theory. The debate seems centered on a lack of consensus about what counts as imagery, what activity can be explained imagistically, and what constitutes evidence for or against an image theory.

In discussing the origins and implications of imagery and fantasy processes, Singer (1974) noted:

> Imagery via specific modalities is viewed as one of several major coding systems that the brain has for organizing and storing experience. It has the special properties of being capable of parallel processing and providing particularly vivid ongoing reenactments of previous events with the likely arousal of greater affect than the

verbal encoding system. (p.218).

> He adds: ... the practical necessities of daily living call upon us to ignore much of the ongoing inner processing in order to function effectively in our relationship with others or to steer ourselves through the physical environment. (p.220).

Singer's comments illustrate some complications of imagery. Images appear to guide and affect us, but we likely have little awareness of this guiding; in addition images are somehow different from our linguistic capability. These thoughts are consistent with the 'dual-mind' which would place language in one hemisphere and imagery capability in the other. The next question is the relationship between language and imagery, and the manner in which an interaction between them would be manifest.

Mental imagery and language

The relationship between language and imagery was made succinctly by Pavio (1981):

> ... behavior is mediated by two independent but partially interconnected cognitive systems that are specialized for encoding, organizing, transforming, storing, and retrieving information. One of these (the image system) is specialized for dealing with information about nonverbal objects and events. The other (the verbal system) is specialized for dealing with linguistic information. The theory assumes that

> the two systems differ in the nature of the representational (cognitive) units, the way the units are organized and transformed, and in their function as mediators of performance in perceptual, memory, language, and cognitive tasks. (p.67).

This approach corresponds more or less to an audiovisual metaphor, with the verbal system dealing with linguistic information (speech, print, writing) and the nonverbal system dealing with imagery or memory from all sensory modalities (pictures, sounds, body memory).

The existence of the two independent systems is illustrated by the fact that activity can go on in one system or the other or in both simultaneously. We can imagine a scene without necessarily describing it verbally, talk about some things without experiencing imagery, or do both simultaneously as when we describe a familiar scene from memory. We are capable of imaging familiar things while talking about something entirely different. Such common experiences provide simple evidence of the independence of imagery and language ability. The possibility exists that the imagery as a form of internal perception is capable of influencing the verbal capability and this influence would appear in speech patterns or preferences for certain types of imagery.

The early research was concerned with the effect of emotional or affective meaning on word recognition. Studies compared taboo words (dirty words) with

emotionally neutral ones, or words related to a person's dominant interests or values as compared with words unrelated to such values. In each case the memory and meaning of the words or phrases which were emotionally loaded or unrelated to a person's interests or values were more difficult to remember. This was also true of words flashed at a 'subliminal' level, which produced strong emotional reactions to the visual image of the word, though the words could not be verbalized or even recalled (Pavio, 1981, p.140).

Pavio (1971) discovered that concrete words with high-imagery (dog, cat) had superior recall when compared to abstract low-imagery counterparts (grades, game). These conclusions were confirmed by Richardson (1975) when the studies were extended to concrete high imagery sentences (books were handed out by teachers) and abstract low imagery sentences (the game was played by permission) indicating superior recall for imagery based sentences. (Kuiper, 1977; Marschark, 1977; O'Neill, 1978). The basic thrust of this research was to show that imagery was separate from the verbal encoding. As the subliminal reactions would indicate, imagery supported and improved verbal encoding when available in a word or sentence, but imagery was not absolutely necessary to allow memory of abstract verbal concepts.

The studies cited to this point indicated that there is a functional difference between verbal and imaging

capability and these capabilities and their interactions are testable. The question arises as to the manner in which the interaction might become apparent in normal conversation as opposed to a testing situation.

The verbal mannerisms or style of a person are the simplest indications of the interaction between the right brain imagery in consciousness and the left brain verbalization of its content. Metaphorical language is one of the most basic ways of expressing things which are difficult to express. The general assumption is that metaphor fulfills the necessary communication function of conveying continuous experiential information - the flow of perceptual events over space and time. The metaphor provides a compact representation of the cognitive and perceptual features salient to the metaphor. The metaphor expresses the inexpressble, allowing us to speak of events which do not express literally. Metaphor can through imagery invoke directly the memorable emotion-arousing representation of the event perceived in consciousness (Ortony 1975, 1979). The literal coding of verbal information from imagery in consciousness loses too much in the translation; we are forced to turn to the metaphor.

Language and metaphor

The term metaphoric language opens a field of study which cuts across psychology, philosophy, linguistics, semantics and literary studies. There have been many

studies on metaphor in these disciplines with the emphasis placed on the particular requirements of any given field and has resulted in a proliferation of definitions and distinctions which are not psychologically relevant. For the purpose of this study, metaphor or figurative language is considered to be the forms used in normal conversation and the possible relationships to psychological function and learning.

Kopps (1971) defined metaphor as "a way of speaking in which one thing is expressed in terms of another, whereby this bringing together throws light on what is being discussed" (p.17). There is a classical Aristotelian view of this definition which would relegate figurative language to the level of ornamentation of the pure literal language. Hawkes (1972) states "literal language reveals the 'reality' of the world which lies unchanging, beyond it", while later adding, figurative language , on the other hand, is viewed like the seasoning in meat, adding flavor, charm and distinction, but adds nothing substantial to its content" (p.90).

However instead of seeing language as describing objective reality in the classical view, it is possible to take the romantic view which sees language as an interaction with the 'bare facts' of the world, resulting in the creation of reality. This view of metaphoric language is not of 'seasoning' the facts of the world; instead is "a way of experiencing the facts. It is a way of thinking about living;

an imaginative projection of the truth' and in addition "intensifies language's characteristic activity and involves quite literally, the creation of 'new' reality" (Hawkes. 1972, p.90).

The primary mode of teaching and counseling is speech. Researchers and theorists have suggested that in addition to communicating, language may also have considerable affect on peoples thought processes and their perception of reality. Though the language process and its relation to reality has been studied, figurative or metaphoric language has received scant attention. Embler (1959) explained that words such as up, down, hard, soft, big, and small are often used figuratively in ways which reveal many of our deep seated beliefs and mental attitudes accepted within our culture.

In the study of language it is often accepted that the use of literal language is significantly different from figurative language, in that the latter is more capable of expressing thoughts or feelings which are otherwise inexpressble. As explained by Asch (1958), "we describe the workings of emotions, ideas, or trends of character, we almost invariably employ terms that also denote properties and processes observable in the world of nature." (p.86). This view of metaphor wassupported by Mair (1977):

> We see metaphor in use when we or others try to grasp or convey personal experience, feelings or almost inarticulate concerns. we talk of

> feeling 'high' or 'low, 'rough' or 'flattened', 'torn apart' or 'hemmed in', 'depressed or 'elevated', 'warmly' or 'coldly'. All these are of course, metaphors carried over from the physical world to allow us some means of patterning that which we can dimly sense but cannot see or touch physically. Such metaphors help us to 'grasp' or 'get a hold of' what we experience, they allow us to 'get things out' so that we can 'do something with them'. (p.24)

Pollio et al. (1977) commented as follows: "most psychotherapists will attest to the rich and disturbingly imaginitive metaphoric articulations patients often make in their attempts to solve perplexing problems, unconscious processes are alway present in the production and understanding of metaphor"(p.105). The idea that metaphorical expressions are unconscious in origin, a form of repressed ideas, emotions or experiences and that their true meanings are always hidden seems to be a common theme in the literature on metaphors in psychology. The metaphor is usually considered to be below the surface, requiring dreams, free associations, responses to projective tests, psychodynamic interpretation to ferret out their meanings. (Knapp, 1960; Voth, 1970; Lewin, 1971; Rubenstein, 1972; Barish, 1977; Billow, 1977) Some expressions are defensive in nature; they provide a patient "some necessary emotional distance from the underlying unconscious thoughts, feelings, fantasy formations, and conflicts", while at the same time providing " an

opportunity for discharge of these underlying feelings and thoughts, however hidden" (Barish, 1977, p.233) It would appear that the figurative language is an indicator of the struggle of students or clients to express some sense of themselves on subjects which they are unsure or lack a definition for what they are experiencing in their consciousness.

The use of figurative language to express a sense of the ongoing internal processing of an individual was most clearly demonstrated by the hypnotist and psychotherapist Milton Erickson when he turned the use of metaphor around to elicit internal processing. Erickson's use of 'therapeutic metaphor' was analyzed in detail in the Neuro Linguistic Programming (NLP) school of therapy. The metaphoric story told by the therapist is an analogy of the patient's situation, and listening to the successful resolution of the problem results in the patient solving his own problem in a similar manner. The metaphor is considered to access the client's 'model' of the world directly with no intermediate verbal translations in the process (Bandler & Grinder, 1979; Gordon, 1978; Brydon & Nugent, 1979; Watzlawick, 1978; Lankton, 1980).

The NLP model of the world also assumes that imagery is a major contributor to the nature of a person's world view, Bandler and Grinder (1976) stated:

> We do not operate directly or immediately upon the world, but rather, we operate within

> the world using a map or a series of maps of that world to guide our behavior within it. These maps, or representational systems, necessarily differ from the territory that they model by the three universal processes of human modeling: Generalization, Deletion, and Distortion. When people come to us in therapy expressing pain and dissatisfaction, the limitations which they experience are, typically, in their representation of the world and not in the world itself.
>
> The most thoroughly studied and best understood representational systems of human modeling maps is that of human language.(p.3)

The 'representational model' in NLP terms specifically spells out that the sensory completness of the 'representation' of past experience or belief is a major contributor to psychological health. Sensory modality metaphors or predicates are indicators of the modality of the imagery in which the experience has been represented.

Metaphor and modalities

Though any experience is generally thought of in terms of the happening (taking a walk, eating dinner) it is first and foremost an event of the senses, and then and only then can it be remembered, reexperienced, interpreted and given value and meaning. When remembering a representation of an event, one's imagery is subject to the filtering of belief systems and the problems of verbal interpretation.

The possibility exists that experiencing an event and

reexperiencing the representation of an event are both a form of sensory happening in consciousness. The sensory nature of most representations may be an indication of a fundamental connection between the inner and outer life. The verbal expression of the representation with its deletions, distortions, and generalizations will generate language with specific figurative or metaphoric content. The imagery driving the belief structure and one's view of life becomes apparent in the mannerisms of speech which develop in the struggle to express the inexpressble.

We could 'see' that people with a superior ability or preference for imagery of a visual nature would generate metaphors or speech patterns in which we 'see' a visual orientation. While this idea has been 'heard' by auditorily oriented people, their representation would be different and we could 'hear' this in their verbalizations. If we 'feel' that there is any validity to the 'body' of this argument then the content of speech should 'point' to a portion of a person's inner orientation. With the ability to match a small portion of the requirements of a person's consciousness we become more able to understand them and be understood by them.

In the understanding of consciousnesses and the inner life, the specific interest would be in imagery which can be described in terms of forms, colors, sounds, smells, tastes, temperatures, and the like, the thoughts which have come to be known as 'sensory modalities' rather than the

awareness of current perceptual activity. The modalities most commonly thought of would be visual, auditory, and kinesthetic. Though smell and taste are available they would be difficult to operationalize in a test and even more difficult to interpret in terms of a representation.

The investigation of modalities is but one small facet of a complex of subjects such as consciousnesses, belief systems, imagery and metaphor, but it may represent a method of arriving at a basic understanding of a person's personal definition of self and the world. The modality of choice or superior ability seems to be an excellent way for students to learn or for clients to express their problems. If we can identify modalities, we can then orient our teaching or counseling to give people information in the modality which they are best able to understand.

CHAPTER III

METHODOLOGY

Hypotheses

The purpose of the present study was to investigate the assumption that modalities exist and that these modalities could be identified. The specific intent of the study was to develop an instrument for the measurement of modality preference in learning or recall of past experience.

An important hypothesis for this study is that available techniques of modality measurement will correlate, indicating they measure the same phenomenon. In addition, it is hypothesized that modality preferences will correlate with past history, which may have helped establish the preference. It is also hypothesized that modality preference will correlate with educational achievement, which might be affected by a preference. The present study will be limited to measurement techniques which test the three major representational modalities and are capable being used in group tested. The past history of the participants will be drawn from readily available sociological data such as age, sex, family characteristics, and school marks.

Primary Hypothesis

The major hypothesis of this study is that modalities

can be tested by a number of methods and individuals who score high on one test of modality will also score high on other tests of modality. Modality is assumed to be manifest linguistically, in task orientation, in self assessment and predicate preference.

Hypothesis I: Individuals scoring high on one test of visual, auditory, or kinesthetic modality will score high on other tests of modality. Specifically: Modality preference will correlate between tests of modality.

Secondary Hypothesis

Since it is assumed that modality preference is a function of the past experience, learnings, or personal cognitive strategies, then individuals with similar preferences should have similar backgrounds. Comparisons based on age, sex, birth position, success in athletics, music, English, mathematics, and computing sciences could be related to modality preference.

Hypothesis II. A group of individuals with high scores in a given modality will have similar backgrounds.

Tertiary Hypothesis

Since modality preference is assumed to give superior capability for the handling of different tasks or learnings, then individuals with similar capabilities should show similar modality preferences.

Hypotheses III: A group of individuals with similar

educational success will have similar modality preferences.

Definitions

The following operational definitions were adopted for use in this study.

(1) The extent of an individual's modality preference was considered to have been defined by the scores obtained on the visual, auditory, and kinesthetic portions of the four test instruments: Verbalizer-Visualizer Quiz (VVQ), Modality Index (MI), Questionnaire on Vividness of Mental Imagery (QVMI), and Representational System Bias Test (RSBT).

(2) Educational achievement was defined by the self-reported answers on the background profile.

(3) Personal history was defined by self reported answers on the background profile.

The Sample

Undergraduate students in the Faculty of Education at the University of Alberta served as subjects for this study. The students were enrolled in the 1987 winter session in Edpsy 495, a course in communication theory and the tested items were an integral part of the course material. The total number was 97; 73 females and 24 males. The mean age was 25.17 years, with the youngest 20 and the oldest 45 years old. The sample was skewed toward the higher ages with the greatest representation in the early

twenties, 47/97 age 21 or 22. The greater proportion of females in the sample is a function of class enrolment.

Instruments

This study will use four different tests in an endeavor to confirm the existence of modality preference: correlations will be used to demonstrate that the tests may be measuring the same phenomenon. The tests will be representative of existing tests and will contain newly developed portions to explore the possibility of developing techniques for producing a new measurement instrument. The test results will be correlated to past history and educational achievement to confirm if any simple relationships exist in the choice of a preferred modality.

The instruments chosen for this study are based on the type of test used by researchers with slightly different viewpoints of modalities and their manifestation. Basically, these instruments endeavour to measure linguistic-cognitive processing in the Verbalizer- Visualizer Quiz (VVQ), task capability in the Modality Index (MI), personal assessment in the Questionnaire on Vividness of Mental Imagery (QVMI), and personal predicate preference on the Representational System Bias Test (RSBT).

Each of the instruments had additional questions or material added to improve on the testing of the modality constructs. The original questions and the added questions were pilot tested and the means of the original and added

questions of all instruments were "t" tested against each other and no differences were found at the .01 significance level. The added questions were therefore considered to be equivalent to the original.

In the case of VVQ where no original kinesthetic subtest was available for comparison, the added material was accepted as valid. The kinesthetic test for the MI was modified to sandpaper cutouts from the original Swassing-Barbe wooden cutouts; this was not considered a significant change from the original task.

Verbalizer-Visualizer Quiz (VVQ)

This test was devised by Pavio (1971), and its abbreviated form, the Verbalizer-Visualizer Quiz (VVQ), defined by Richardson, (1977), assess two Habitual thinking modes: imaginal and verbal. Visualizers have been shown to be better than verbalizers in recall of high-imagery material (Hiscock, 1976), have more regular breathing patterns (Richardson, 1977), have less uniform eye movement responses (Richardson, 1978), and have more spontaneous visual extrasensory experiences (Irwin, 1979).

Test-retest reliablity on 153 Junior High School Students over 3 week interval show an r=.49. (Warren & Good, 1979)

The original works of Pavio supported a relationship between the concreteness of words and the ability to

remember the words. Words with defined pictorial content (apple, car) were easier to remember then abstract, non-pictorial words (love, fast). Pavio's coresearchers discovered that people blind from birth responded to the words with pictorial content as though they were abstract, but responded to words based on sound (bong, crash) as though they were concrete (Pavio & Okourata, 1971; Richarson, 1977). This combination resulted in a quiz which demonstrated that some thinkers were predominantly pictorially oriented while others were predominantly verbally oriented.

This dual-coding model of human processing assumed that natural human though was defined by the abilities to represent linguistic content in concrete or abstract form. Though the original assumptions are not in terms of modalities, they are similar, even to the extent that Pavio (1981) mentions kinesthetics as a possible link between visual and verbal. For the purposes of adding the kinesthetic modality it was assumed that the response to feeling words (soft, anger) would follow the same pattern as visually or verbally oriented words.

Modality Index (MI)

The Modality Index (MI), a group administered instrument, is a modification of the Swassing-Barbe Modality Index (SBMI) which is normally individually administered. The specifications available on the SBMI

indicates it is usable for children and adults. The data available were produced from a sample of 600 and during factor analysis indicated separation on the basis of modality with a relationship to short term memory.

The validity of this instrument was unsubstantiated as Swassing-Barbe (1979) stated "there is no criterion that is a widely accepted measure of modality strengths". The test-retest reliability of .58, and reliability coefficients for visual (0.61), auditory (0.65), and kinesthetic subtests (0.67) are acceptable for use on a broad construct such as modality. Assuming data to conform to a Guttman scale a coefficient of reproducability exceeding .90 and coefficients of scalability approaching .60 were produced for all 3 subscales. (Swazzing-Barbe, 1979)

Questionnaire on Vividness of Mental Imagery (QVMI)

As summarized by Sheeham et al. (1983) original Betts Questionnaire on Vividness of Mental Imagery (QVMI) or modified versions of the QVMI have been related to creativity in men but not women , improved physical performance using mental practice , increase in heart rate , field independence in women , extraversion -introversion , higher sexual arousal , and psychadelic drug flashbacks (Sheeham et al., 1978, p201).

Marks (1973) produced an extended version of the QVMI visual imagery subscale. This test relates positively to cross-modal matching, paired association recall ,

Hypnotizability, frequency of dream recall , extent of acceleratory heart control, memory performance , memory task performance on people using image coding strategy , equivalence between imagery and perception, and right lateral eye movements (Sheeham et al., 1978, p202).

The QVMI internal reliability was found to be .90-.94, using 147 undergraduate students (Wescott & Rosenstock, 1976). The test-retest reliability was found to be r=.72-.75 using147 undergraduates over a 2 week interval.

Betts originally developed his 65 question inventory of mental imagery in 1909 which used a 7-point Likert scale to assess the extent of a person's facility for using 7 different types of imagery. The original test used visual, auditory, cutaneous, kinesthetic, gustatory, olfactory, and organic; however for the purposes of this study only the visual, auditory and kinesthetic portions of the test were used. A number of the images involved (locomotive whistles, steam escaping) were exchanged for more contemporary images (car horn, construction site noises).

Representational System Bias Test (RSBT)

The testing of representational systems in the field of Neuro Linguistic Programming (NLP) is based on the works of Chomsky, Erickson, Satir and Perls. With respect to modalities NLP is assuming that the expression of all language from linguistic deep structures or belief systems which will produce a distinctive predicate bias for each

modality. The testing of predicates in this system is usually done on a phenomenological basis with the client or student in direct communication with the psychologist or teacher. The RSBT is derived from the practice of Lewis and Pucelik (1982) who are currently using it to define modalities of clients and as a demonstration in seminars of the different modality preferences within a group. There is no current empirical research to support the relationship between predicates and modalities.

Test Administration

All instruments selected for this study were considered to be suitable for group administration. The entire battery of tests required approximately 60 minutes to administer and was completed in one seminar period. All tests were done by all subjects, with only one uncorrectable error which reduced the sample to 96, some questions on individual background profiles were not answered.

The tests were administered to 5 seminar groups ranging in size from 15 to 25 subjects. The tests were administered by 3 different seminar leaders using a prepared script and guide to assure similarity of presentation. The VVQ and MI used timed intervals for presenting items to be committed to memory, timed intervals before response and an open response time. The QVMI, RSBT and background profile used open response

times. Answer sheets were presented at the end of testing and the tests were self scored by the participants. All responses were checked and rescored when necessary.

CHAPTER IV

RESULTS

Statistical Analysis

In order to test the primary hypotheses, the scores for the Verbalizer-Visualizer Quiz (VVQ), Modality Index (MI), Questionnaire on Vividness on Mental Imagery (QVMI), and the Representational System Bias Test (RSBT) were divided into groups on the basis of modality subtest. This resulted in three modality groupings (visual, auditory, kinesthetic) with n=96 and four separate test scores in each grouping. The scores for each modality grouping were then analyzed using the Pearson Product Moment correlation coefficient between the four tests.

Results

Table 1 presents the averages and standard deviations for the four tests and Table 2 presents the correlation matrix for the Pearson Product Moments calculated between the four tests when grouped on the basis of the three modalities.

Primary Hypothesis:

It was hypothesized that a group of individuals scoring high on one test of visula, auditory, or kinesthetic modality will score high on other tests of modality. Specifically: modality preference will be correlated between tests of modality.

TABLE 1
SUMMARY OF PRETREATMENT DATA

VERBALIZER-VISUALIZER QUIZ (VVQ)

n=96	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	7.09	6.18	5.91
STD DEV	1.46	1.71	1.64

MODALITY INDEX (MI)

n=96	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	16.12	12.01	6.93
STD DEV	2.69	3.25	3.68

QUIZ ON VIVIDNESS OF MENTAL IMAGERY (QVMI)

n=96	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	56.68	55.22	56.31
STD DEV	6.88	10.53	9.16

REPRESENTATIONAL SYSTEM BIAS TEST (RSBT)

n=96	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	18.81	19.27	21.47
STD DEV	6.88	3.72	3.91

TABLE 2
SUMMARY OF PRODUCT MOMENT CORRELATIONS

VISUAL PRODUCT MOMENT CORRELATION

n=96	VVQ	MI	QVMI	RSBT
VVQ	r= 1.00	r=-0.03	r= 0.00	r= 0.05
MI		r= 1.00	r=-0.01	r= 0.10
QVMI			r= 1.00	r= 0.11
RSBT				r= 1.00

AUDITORY PRODUCT MOMENT CORRELATION

n=96	VVQ	MI	QVMI	RSBT
VVQ	r= 1.00	r= 0.04	r= 0.10	r= 0.09
MI		r= 1.00	r= 0.10	r=-0.11
QVMI			r= 1.00	r= 0.07
RSBT				r= 1.00

KINESTHETIC PRODUCT MOMENT CORRELATION

n=96	VVQ	MI	QVMI	RSBT
VVQ	r= 1.00	r=-0.02	r= 0.00	r=-0.01
MI		r= 1.00	r=-0.15	r= 0.02
QVMI			r= 1.00	r= 0.19
RSBT				r= 1.00

The correlation matrix for all modalities failed to achieve coefficients exceeding 0.195 (requires r=0.195, df=96, p=0.05) ,which indicated no significant correlation between test techniques at the 0.05 level. Kinesthetic QVMI vs RSBT is the only instance in which the correlation exceeds 0.169 (requires r=0.169, df=96, p=0.10) for significance at the .10 level.

Conclusion: The lack of any significant correlation leaves the primary hypothesis unconfirmed. The modality construct can not be confirmed by these four measurement techniques.

Further Analysis

Failure to confirm the primary hypothesis and the general uncorrelated nature of the test data left the testing of the secondary hypotheses in doubt, as no confirmation of the modality construct could be made without a relationship between the test techniques. It was decided the existing data base could be checked for possible relationships which might exist on an item by item basis and the related items could be used to confirm the concept of modality.

The data for the three modalities were subjected to factor analysis using Varimax with Kaiser normalization rotation after principal factor extraction. On the basis of initial analysis using the Skree test, it was decided five factors were representative of the major relationships

existing in the data and in addition accumulated greater than 37.5% of the total variance. The factor loading of 0.40 was chosen to minimize the instances of items loading on more than one factor and to approximate simple structure. The results of these factor analyses which meet the Skree test, and the 0.40 standard for factor score are presented in Tables 3, 4 and 5.

The visual analysis demonstrated the weighting of the first three factors is to the MI, and the first and second halves of of the QVMI, factor 4 weighs slightly against the RSBT, but no significant factor exists for the VVQ.

The auditory analysis demonstrated weighting of the first two factors against the QVMI and the MI, while factor 4 weighs against the RSBT, factors 4 and 5 give some weight to the VVQ.

The kinesthetic analysis demonstrated weighting of the first two factors against the QVMI and the MI, with factor 3 weighing against the RSBT, and the 4 factor weighing against the MI.

Initial results

The factor analysis on the basis of modality demonstrated a separation of factors on a test by test basis, which is consistent with the general lack of correlation between test techniques. The concept of modality preference can not be supported by any item by item relationship between tests. The low weighting of

TABLE 3
VISUAL FACTOR ANALYSIS

FACTOR	#1	#2	#3	#4	#5
EIGENVALUE	4.03	3.63	2.72	2.27	1.97
% VARIANCE	10.3	9.3	7.0	5.8	5.1
TOTAL %	10.3	19.7	26.6	32.4	37.5
VVQ 1	.....	.....	.....	.....	.496
VVQ 2	.....	.....	.....	.....	.503
VVQ 3	.....	.....	.....	.....	.....
VVQ 4	.....	.....	.....	.....	.....
VVQ 5	.....	.....	.....	.....	.....
VVQ 6	.....	.....	.....	.410	.....
VVQ 7	.....	.....	.....	.....	.....
VVQ 8	.....	.....	.....	.....	.....
VVQ 9	.....	.....	.....	.....	.....
VVQ 10	.....	.....	.....	.....	.....
MI 1	.539	.....	.....	.....	.....
MI 2	.....	.526	.....	.....	.....
MI 3	.595	.....	.....	.....	.....
MI 4	.629	.....	.....	.....	.....
MI 5	.473	.....	.....	.....	.....
MI 6	.746	.....	.....	.....	.....
MI 7	.615	.....	.....	.....	.....
MI 8	.607	.....	.....	.....	.....
MI 9	.697	.....	.....	.....	.....
QVMI 1	.....	.....	.657	.....	.....
QVMI 2	.....	.....	.690	.....	.....
QVMI 3	.....	.....	.550	.....	.....
QVMI 4	.....	.....	.613	.....	.....
QVMI 5	.....	.437	.582	.....	.....
QVMI 6	.....	.607	.....	.....	.....
QVMI 7	.....	.488	.....	.....	.....
QVMI 8	.....	.801	.....	.....	.....
QVMI 9	.....	.439	.....	.....	.....
QVMI 10	.....	.654	.....	.....	.....
RSBT 1	.....	.....	.....	.406	.....
RSBT 2	.....	.....	.....	.....	.....
RSBT 3	.....	.....	.....	.....	.....
RSBT 4	.....	.....	.....	.....	.427
RSBT 5	.....	.....	.....	.....	.....
RSBT 6	.....	.....	.....	.....	.....
RSBT 7	.....	.....	.....	.721	.....
RSBT 8	.....	.....	.....	.663	.....
RSBT 9	.....	.....	.....	.....	.....
RSBT 10	.....	.....	.....	.441	.....

TABLE 4
AUDITORY FACTOR ANALYSIS

FACTOR	#1	#2	#3	#4	#5
EIGENVALUE	6.19	2.86	2.52	2.09	1.93
% VARIANCE	15.9	7.3	6.5	5.3	5.0
TOTAL %	15.9	23.2	29.7	35.0	40.0
VVQ 1	.....	.....	.....	.456	.....
VVQ 2	.....	.....	.....	.....	.455
VVQ 3	.....	.....	.....	.....	.422
VVQ 4	.....	.....	.....	.....	.....
VVQ 5	.....	.....	.....	.....	.460
VVQ 6	.....	.....	.....	.....	.425
VVQ 7	.....	.....	.....	.....	.....
VVQ 8	.....	.....	.....	.....	.....
VVQ 9	.....	.....	.....	.413	.....
VVQ 10	.....	.....	.....	.436	.....
MI 1	.....	.....	.....	.....	.....
MI 2	.....	.616	.....	.....	.....
MI 3	.....	.....	.....	.....	.....
MI 4	.....	.685	.....	.....	.....
MI 5	.....	.635	.....	.....	.....
MI 6	.....	.510	.....	.....	.....
MI 7	.....	.680	.....	.....	.....
MI 8	.....	.....	.....	.....	.....
MI 9	.....	.604	.....	.....	.....
QVMI 1	.758	.....	.....	.....	.....
QVMI 2	.677	.....	.....	.....	.....
QVMI 3	.838	.....	.....	.....	.....
QVMI 4	.766	.....	.....	.....	.....
QVMI 5	.750	.....	.....	.....	.....
QVMI 6	.768	.....	.....	.....	.....
QVMI 7	.546	.....	.....	.....	.....
QVMI 8	.737	.....	.....	.....	.....
QVMI 9	.653	.....	.....	.....	.....
QVMI 10	.780	.....	.....	.....	.....
RSBT 1	.....	.....	.....	.....	.417
RSBT 2	.....	.....	.446	.....	.....
RSBT 3	.....	.....	.....	.....	.....
RSBT 4	.....	.....	.....	.....	.....
RSBT 5	.....	.....	.....	.....	.....
RSBT 6	.....	.....	.....	.....	.....
RSBT 7	.....	.....	.490	.....	.....
RSBT 8	.....	.....	.586	.....	.....
RSBT 9	.....	.....	.618	.....	.....
RSBT 10	.....	.....	.591	.....	.....

TABLE 5
KINESTHETIC FACTOR ANALYSIS

FACTOR	#1	#2	#3	#4	#5
EIGENVALUE	5.34	2.90	2.40	2.09	1.98
% VARIANCE	13.7	7.4	6.2	5.4	5.1
TOTAL %	13.7	21.1	27.3	32.6	37.7
VVQ 1	.....	.....	.....	.....	.588
VVQ 2	.....	.....	.....	.478	.....
VVQ 3	.....	.....	.....	.....	.....
VVQ 4	.....	.....	.....	.....	.....
VVQ 5	.....	.....	.....	.....	.....
VVQ 6	.....	.....	.....	.....	.....
VVQ 7	.....	.....	.....	.....	.....
VVQ 8	.....	.....	.....	.477	.....
VVQ 9	.....	.....	.....	.479	.....
VVQ 10	.....	.....	.....	.546	.....
MI 1	.....	.465	.....	.....	.....
MI 2	.....	.695	.....	.....	.....
MI 3	.....	.....	.....	.....	.....
MI 4	.....	.....	.....	.....	.....
MI 5	.....	.696	.....	.....	.....
MI 6	.....	.627	.....	.....	.....
MI 7	.....	.....	.....	.....	.....
MI 8	.....	.525	.....	.....	.473
MI 9	.....	.746	.....	.....	.....
QVMI 1	.414	.....	.....	.....	.....
QVMI 2	.623	.....	.....	.....	.....
QVMI 3	.726	.....	.....	.....	.....
QVMI 4	.699	.....	.....	.....	.....
QVMI 5	.678	.....	.....	.....	.....
QVMI 6	.754	.....	.....	.....	.....
QVMI 7	.776	.....	.....	.....	.....
QVMI 8	.758	.....	.....	.....	.....
QVMI 9	.691	.....	.....	.....	.....
QVMI 10	.778	.....	.....	.....	.....
RSBT 1	.....	.....	.....	.....	.....
RSBT 2	.....	.....	.629	.....	.....
RSBT 3	.....	.....	.538	.....	.....
RSBT 4	.....	.....	.....	.....	.....
RSBT 5	.....	.....	.....	.....	.....
RSBT 6	.....	.....	.....	.....	.....
RSBT 7	.....	.....	.572	.....	.....
RSBT 8	.....	.....	.570	.....	.....
RSBT 9	.....	.....	.402	.....	.....
RSBT 10	.....	.....	.520	.....	.....

factors for the RSBT and the indistinct weighting for the VVQ also indicated the possibility of poor test reliability.

The failure to correlate and the separation of the four tests into individual factors during analysis on the basis of modality, indicated that the different test techniques likely test different constructs.

Continuation of Analysis

On the basis of the analysis of the modality factors the data were subjected to further factor analysis on an individual test basis, using Varimax rotation with Kaiser normalization after principle factor extraction, and in addition alpha tests of reliability were calculated using the Kuder-Richardson KR-20 and KR-21 formulae where appropriate.

On the basis of initial analysis using the Skree test, it was decided five factors were representative of the major relationships existing in the data. The factor loading of 0.40 was choosen to minimize the instances of items loading on more than one factor and to approximate a simple structure. The results of these factor analyses which meet the Skree test, and the 0.40 standard for factor loading are presented in Tables 6, 7, 8 and 9.

The analysis of the VVQ presented in Table 6 demonstrates only one factor weighting against a portion of the kinesthetic subtest and an otherwise general lack separation on the basis of modality within main test. The

TABLE 6
VISUALIZER-VERBALIZER QUIZ
FACTOR ANALYSIS AND RELIABILITY COEFFICIENTS

VVQ FACTOR ANALYSIS

FACTOR	#1	#2	#3	#4	#5
EIGENVALUE	2.52	2.20	1.96	1.77	1.62
% VARIANCE	8.4	7.3	6.5	5.9	5.4
TOTAL %	8.4	15.7	22.3	28.2	33.6
VISUAL 1	.....	.....	.534	.....	.....
VISUAL 2	.....	.....	.571	.....	.....
VISUAL 3	.....	.....	.....	.....	.....
VISUAL 4	.....	.....	.....	.....	.....
VISUAL 5	.463	.....	.....	.....	.....
VISUAL 6	.....	.531	.....	.....	.....
VISUAL 7	.....	.....	.....	.453	.....
VISUAL 8	.....	.....	.....	.....	.....
VISUAL 9	.....	.....	.....	.....	.....
VISUAL 10	.....	.....	.....	.....	.....
AUDIO 1	.....	.....	.....	.....	.....
AUDIO 2	.....	.....	.....	.....	.....
AUDIO 3	.....	.....	.....	.....	.....
AUDIO 4	.....	.....	.....	.....	.....
AUDIO 5	.....	.....	.....	.....	.496
AUDIO 6	.....	.....	.....	.408	.....
AUDIO 7	.....	.....	.....	.....	.....
AUDIO 8	.....	.....	.....	.....	.....
AUDIO 9	.....	.426	.....	.....	.....
AUDIO 10	.....	.....	.....	.....	.612
KINO 1	.....	.645	.....	.....	.....
KINO 2	.....	.....	.....	.613	.....
KINO 3	.....	.....	.....	.....	.494
KINO 4	.....	.....	.....	.....	.....
KINO 5	.....	.....	.....	.....	.....
KINO 6	.404	.....	.....	.....	.....
KINO 7	.512	.....	.....	.....	.....
KINO 8	.609	.....	.....	.....	.....
KINO 9	.570	.....	.....	.....	.....
KINO 10	.....	.....	.....	.....	.....

VVQ RELIABILITY COEFFICIENTS

n=96	VISUAL	AUDITORY	KINESTHETIC
	0.06	0.24	0.29

TABLE 7
MODALITY INDEX
FACTOR ANALYSIS AND RELIABILITY COEFFICIENT

MI FACTOR ANALYSIS

FACTOR	#1	#2	#3	#4	#5
EIGENVALUE	3.96	2.71	2.44	1.86	1.63
% VARIANCE	14.7	10.0	9.0	6.9	6.0
TOTAL %	14.7	24.7	33.7	40.6	46.7
VISUAL 1	.600	.....	.....	.....	.....
VISUAL 2	.....	.....	.....	.....	.699
VISUAL 3	.412	.....	.....	.568	.....
VISUAL 4	.618	.....	.....	.....	.....
VISUAL 5	.....	.....	.....	.662	.....
VISUAL 6	.763	.....	.....	.....	.....
VISUAL 7	.621	.....	.....	.....	.....
VISUAL 8	.636	.....	.....	.....	.....
VISUAL 9	.740	.....	.....	.....	.....
AUDIO 1	.....	.....	.....	.....	.654
AUDIO 2	.....	.594	.....	.....	.....
AUDIO 3	.....	.....	.....	.....	.....
AUDIO 4	.....	.615	.....	.....	.....
AUDIO 5	.....	.714	.....	.....	.....
AUDIO 6	.....	.589	.....	.....	.....
AUDIO 7	.....	.747	.....	.....	.....
AUDIO 8	.....	.....	.....	.....	.....
AUDIO 9	.....	.528	.....	.....	.....
KINO 1	.....	.....	.428	.....	.....
KINO 2	.....	.....	.750	.....	.....
KINO 3	.....	.....	.....	.....	.....
KINO 4	.....	.....	.685	.....	.....
KINO 5	.....	.....	.595	.....	.....
KINO 6	.....	.....	.....	.....	.....
KINO 7	.....	.....	.570	.....	.....
KINO 8	.....	.....	.742	.....	.....
KINO 9	.....	.....	.....	.....	.....

MI RELIABILITY COEFFICIENTS

n=96	VISUAL	AUDITORY	KINESTHETIC
	0.764	0.696	0.620

TABLE 8
QUESTIONAIRE ON VIVIDNESS OF MENTAL IMAGERY
FACTOR ANALYSIS AND RELIABILITY COEFFICIENTS

QVMI FACTOR ANALYSIS

FACTOR	#1	#2	#3	#4	#5
EIGENVALUE	10.38	2.22	1.94	1.53	1.44
% VARIANCE	34.6	7.4	6.5	5.1	4.8
TOTAL %	34.6	42.0	48.5	53.6	58.4
VISUAL 1	.....	.....	.....	.678	.....
VISUAL 2	.....	.....	.....	.711	.....
VISUAL 3	.....	.....	.....	.639	.....
VISUAL 4	.....	.....	.....	.640	*.447*
VISUAL 5	.....	.....	.....	.619	.....
VISUAL 6	.....	.....	.647	.....	.....
VISUAL 7	.....	.....	.644	.....	.....
VISUAL 8	.....	.....	.704	.....	.....
VISUAL 9	.....	.....	.528	.....	.....
VISUAL 10	.536	.....	.524	.....	.....
AUDIO 1	.....	.660	.....	.....	.....
AUDIO 2	.551	*.444*	.....	.....	.....
AUDIO 3	.650	*.463*	.....	.....	.....
AUDIO 4	.....	.675	.....	.....	.....
AUDIO 5	.....	.761	.....	.....	.....
AUDIO 6	*.404*	.556	.....	.....	.....
AUDIO 7	.....	.....	*.457*	.....	.....
AUDIO 8	.....	.663	.....	.....	.....
AUDIO 9	.....	.720	.....	.....	.....
AUDIO 10	.563	.518	.....	.....	.....
KINO 1	.....	.....	.....	.....	.796
KINO 2	*.414*	.....	.....	.....	*.481*
KINO 3	.648	.....	.....	.....	.....
KINO 4	.656	.....	.....	.....	.....
KINO 5	.685	.....	.....	.....	.....
KINO 6	.664	.....	.....	.....	.....
KINO 7	.548	.....	.....	.....	*.496*
KINO 8	.699	.....	.....	.....	.....
KINO 9	.504	*.404*	.....	.....	.....
KINO 10	.540	.....	.....	.....	.....

QVMI RELIABILITY COEFFICIENTS

n=96	VISUAL	AUDITORY	KINESTHETIC
	0.707	0.904	0.883

TABLE 9
REPRESENTATIONAL SYSTEM BIAS TEST
FACTOR ANALYSIS AND RELIABILITY COEFFICIENT

RSBT FACTOR ANALYSIS

FACTOR	#1	#2	#3	#4	#5
EIGENVALUE	4.25	3.31	2.37	2.29	2.05
% VARIANCE	14.2	11.0	7.9	7.6	6.8
TOTAL %	14.2	25.2	33.1	40.8	47.6
VISUAL 1	.....	.....	.....	.....	.....
VISUAL 2	.....	.....	.....	.675	.....
VISUAL 3	.....	.....	.....	.....	.....
VISUAL 4	.....	.....	.....	.....	.....
VISUAL 5	.....	.....	.....	.....	.....
VISUAL 6	.....	.....	.....	.....	.....
VISUAL 7	.....	.....	.....	.....	.....
VISUAL 8	.....	.....	.....	.....	.....
VISUAL 9	.....	.....	.....	.568	.....
VISUAL 10	.....	.....	.....	.....	.....
AUDIO 1	.....	.508	.....	.....	.....
AUDIO 2	.....	.....	.....	.....	.....
AUDIO 3	.416	.....	.544	.....	.....
AUDIO 4	.....	.....	.....	.....	.645
AUDIO 5	.....	.....	.....	.....	.512
AUDIO 6	.620	.....	.....	.....	.....
AUDIO 7	.....	.....	.....	.....	.....
AUDIO 8	.....	.....	.....	.....	.....
AUDIO 9	.....	.....	.....	.....	.....
AUDIO 10	.....	.419	.....	.....	.....
KINO 1	.....	.....	.....	.....	.....
KINO 2	.....	.....	.....	.....	.....
KINO 3	.....	.....	.....	.....	.....
KINO 4	.....	.....	.....	.....	.....
KINO 5	.....	.....	.....	.....	.....
KINO 6	.....	.542	.....	.....	.....
KINO 7	.....	.....	.....	.....	.....
KINO 8	.414	.431	.....	.....	.....
KINO 9	.....	.....	.....	.....	.....
KINO 10	.622	.....	.....	.....	.....

RSBT RELIABILITY COEFFICIENTS

n=96	VISUAL	AUDITORY	KINESTHETIC
	0.520	0.461	0.505

lack of consistent factoring is supported by the low reliability coefficients of less than 0.29.

The analysis of the MI presented in Table 7 demonstrates the first three major factors weigh against the modality subtests on an individual test basis, factor one visual, factor two auditory, and factor three kinesthetic. The reliability coefficients ranging from 0.62 to 0.76 indicate an acceptable level of reliability for a test of this nature.

The analysis of the QVMI presented in table 8 demonstrates weighting of the kinesthetic and audio subtests on the first two factors, while factors 3 and 4 represent the first and second halves of the visual subtest. The audio and kinesthetic factors are not as clearly separated due to the weighting of some items against more then one factor with the factor loading set at 0.40 The items which load on two functions can be virtually eliminated by setting the factor loading to 0.50 and eliminating the values in *italics*. The reliablity coefficients for this test which range between 0.71 and 0.90 are entirely acceptable.

The analysis of the RSBT presents no reasonable weighting of factors on the basis of modality, while the range of reliability coefficient from 0.46 to 0.52 is also questionable.

Results Continued

The low separation of modality factors and the low reliability coefficients of the VVQ and the RSBT suggested these techniques have no applicability for testing modality.

The MI and the QVMI with higher weighting and separation of factors on the basis of modality, in addition to higher reliability coefficients, illustrates the possibility of using these tests on the basis of modality.

Preparation of comparison data

For the purposes of comparison and discussion, statistics for the original and current QVMI and MI were prepared. The QVMI was compared on the basis of % distribution and intra-test Pearson's product moment correlations and are presented in Table 10. The original Swassing-Barbe Modality Index and the current MI were compared on the basis of raw scores and % scores and are presented in Table 11. Intra-test Pearson's product moment correlations for the MI were calculated for the raw scores and % scores and are presented in Table 12.

Conclusions

In summary, the findings of these analyses suggest the following conclusions.

1. The four techniques suggested as possible methods of testing the concept of modality are not correlated and as a result can not be used to confirm the characteristics of

TABLE 10
COMPARISONS OF BETTS ORIGINAL VS CURRENT QUESTIONNAIRE ON VIVIDNESS OF MENTAL IMAGERY

PERCENTAGE DISTRIBUTION OF RESPONSES

	VISUAL		AUDITORY		KINESTHETIC	
	BETTS	CURRENT	BETTS	CURRENT	BETTS	CURRENT
7	18	22	21	22	23	25
6	38	42	35	35	29	37
5	23	22	21	24	23	23
4	10	9	14	13	14	8
3	5	5	4	4	7	5
2	3	0	2	1	2	1
1	2	0	3	1	2	1

CURRENT QUESTIONNAIRE ON VIVIDNESS OF MENTAL IMAGERY INTRA-TEST PRODUCT MOMENT CORRELATIONS

n=96	VIS/AUD	VIS/KIN	AUD/KIN
	r= 0.51	r= 0.50	r = 0.73

BETTS ORIGINAL QUESTIONNAIRE ON VIVIDNESS OF MENTAL IMAGERY INTRA-TEST PRODUCT MOMENT CORRELATIONS

n=143	VIS/AUD	VIS/KIN	AUD/KIN
	r= 0.53	r= 0.52	r = 0.65

TABLE 11
MODALITY INDEX RAW SCORES AND % SCORES

MODALITY INDEX (RAW SCORES CONVERTED)

n=96	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	21.77	16.21	9.35
STD DEV	3.63	4.38	4.97

SWASSING-BARBE MODALITY INDEX (RAW SCORES)

n=637	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	19.18	16.81	16.38
STD DEV	10.50	7.34	9.26

MODALITY INDEX (% SCORES)

n=96	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	46.38	34.33	19.09
STD DEV	7.73	7.35	8.74

SWASSING-BARBE MODALITY INDEX (% SCORES)

n=637	VISUAL	AUDITORY	KINESTHETIC
AVERAGE	36.18	33.89	29.92
STD DEV	11.19	9.91	10.46

TABLE 12
MODALITY INDEX INTRA-TEST CORRELATIONS

MODALITY INDEX (RAW SCORES)
INTRA-TEST PRODUCT MOMENT CORRELATIONS

n=96	VIS/AUD	VIS/KIN	AUD/KIN
	r= 0.12	r= 0.11	r = 0.03

SWASSING-BARBE MODALITY INDEX (RAW SCORES)
INTRA-TEST PRODUCT MOMENT CORRELATIONS

n=637	VIS/AUD	VIS/KIN	AUD/KIN
	r= 0.13	r= 0.43	r = 0.25

MODALITY INDEX (% SCORES)
INTRA-TEST PRODUCT MOMENT CORRELATIONS

n=96	VIS/AUD	VIS/KIN	AUD/KIN
	r= -0.27	r= -0.60	r = -0.54

SWASSING-BARBE MODALITY INDEX (% SCORES)
INTRA-TEST PRODUCT MOMENT CORRELATIONS

n=637	VIS/AUD	VIS/KIN	AUD/KIN
	r= -0.49	r= -0.51	r = -0.50

subjects with a preferred modality.

2. The unreliability and failure to factor on the basis of modality eliminates the Verbalizer-Visualizer Quiz and Representational Bias Test from further investigation as these methods do not appear to test any consistent factor.
3. The Modality Index and Questionnaire on Vividness of Mental Imagery show separation of factors on the basis of modality, however the factors represented are different and further study would be required to confirm if one or both instruments is testing modality.

Chapter V

DISCUSSION AND IMPLICATIONS

Discussion

The main purpose of this research was to investigate the effectiveness of measuring modality orientations in mental imagery using four different testing methods. In general terms, the study involved confirming the correlation of four methods of testing modality preference for the visual, auditory, and kinesthetic modalities.

The data obtained from this sample suggest that the ability to test for a modality preference with these instruments is in question. The lack of correlation between the tests suggests that if there is a modality-based preference involved in answering questions or doing tasks, it is not supported by the chosen methods and the primary hypothesis was considered unconfirmed. The secondary and tertiary hypothesis were also considered to be uncomfirmed, since no modality preference could be established for comparison to the subjects background profile.

The lack of correlation between tests gave rise to the further investigation of the relationships which might exist within the data available after administering the four tests. Using the Varimax rotation after principal factor extraction for each modality on the four tests supported the lack of correlation between tests, the factors extracted were not

common to all tests and indicated the tests failed to support a common construct.

Further use of the Varimax rotation on a test by test basis indicated that the Representational System Bias Test (RSBT) and the Verbalizer-Visualizer Quiz (VVQ) were unable to separate factors which were different for each modality and in addition alpha reliability coefficients of less then .52 for all parts of these tests indicated low reliability. This effectively removes them from any possibility of being used to support a modality construct in their present form. However, as the following discussion indicates, these tests might still yield useful results if the test methodology were changed.

The RSBT is representative of a phenomenologically based set of observations undertaken by Bandler and Grinder (1975) which investigated the deletions, distortions, and generalizations in the language structures of clients with psychological problems. Specifically, they stated: "We use language to represent our experience - this is a very private process. We then use language to represent our representation of our experience - a social process."(p.38) With reference to the RSBT we would possibly be tapping into the social process of expression, while the observation of shifts in the language patterns of troubled clients is part of the private process involved in expressing personal problems. The test might produce totally different results when used with troubled clients, or

when the test was specifically designed to identify areas of client difficulty.

The VVQ in its current form suffers a problem of reliability and a lack of separation on even the visual or auditory modalities which Pavio (1971) would have predicted. The reliability of the results which Pavio produced with his studies was based on many test-retest processes, which may account for the failure of the single application of this test. Possibly in a more extensive test and retest methodology this instrument might also produce a separation on the basis of modality.

The Questionnaire on Vividness of Mental Imagery (QVMI) and the Modality Index (MI) were both able to separate factors for each modality, however they separated different factors for each modality, indicating they are testing different concepts of the modality construct. The alpha reliability coefficients exceeding .62 indicated the reliability of the tests is great enough to justify their improvement.

The QVMI and the MI suffer one large drawback when we endeavor to compare their results. The QVMI is a self assessment of internal processes, the results in Table 1 indicate an average rating for all modalities of 56.0 on a scale of 70, and all three modalities within 0.7 of this average. We must question the possibility that virtually all images, in all modalities, are rated midway between 'Moderately clear and vivid' and 'Very clear and

comparable in vividness to the actual experience.' Can the imagery be this clear in all modalities?

Studies using the Learning Style Inventory, which is also a self assessment instrument indicated that most of 350,000 tested could define their own learning style independent of the test. (Dunn, Debello, Brennan, & Murrain, 1981). Though this evidence comes from a different test, it is indicative that personal evaluation of self can be related to testable results. In addition, the comparison of the percentage distributions (no other original statistical data exists) of the Betts original and the current QVMI in Table10, indicates that the distribution is virtually identical with the exception of the response to kinesthetic #6. In addition the comparisons of the inter-test correlations in Table 10 demonstrated that the relationships between the modality scores are virtually identical for the Betts original and the QVMI. We can assume that the current test basically conforms to expectations and produces results similar to Betts original QVMI.

The Swassing-Barbe Modality Index (SBMI) and the current Modality Index (MI) raw score averages in Table 11 indicate that there is a large difference between the results produced by these tests. This difference might be expected as Price's study (1980) of 3,972 subjects in grades three through seven verified that the younger the child the more tactile/kinesthetic they were. Those

modalities were followed by the development of visual strengths, and beginning with grades five and six, the development of the ability to remember increasing amounts of information through the auditory modality. Keefe (1979) also reported that "Perceptual preference seems to evolve for most students from psychomotor (tactile/kinesthetic) to visual and aural as the learner matures." On the basis of these studies the older age of the group involved in the current study would account for the increased scores in visual and auditory modalities.

It is necessary to comment on one questionable practice in the scoring of the Swassing-Barbe Modality Index. Swassing-Barbe (1979, p.39) require raw scores be converted to % scores, based on a subject's total score, as illustrated in Table 12. Using the required calculations a student with scores of visual = 10, auditory = 5, and kinesthetic = 5 receives % scores of 50%, 25%, and 25% respectively. A student with scores of 4, 2 and 2 would receive identical % scores of 50%, 25% and 25%, even though every score is significantly lower. Though this is a simple operation, it does significantly modify some of the statistics, as illustrated in Table 12, where it can be seen that relatively small positive correlations (0.1 to 0.4) are converted to even larger negative correlations (-0.3 to -0.6). The rational by Swassing-Barbe is that this limits the effects of intelligence, and in addition the test is a between scores comparison of an individual, rather then a

comparison between people. If this operation is accepted we see that the relationship between the modalities, and the indication of modality preference have been artificially enhanced by the conversion to % scores. However we are at liberty to do our comparisons at the raw score level and avoid the problems associated with the conversion to % scores.

Summary

The initial correlations indicated no readily available relationships between the four test methods. The extension of the statistical method into item analysis of modality subtests and the individual tests has only confirmed the original findings. Though the QVMI and the MI have demonstrated the ability to separate factors on the basis of modality subtests they separate different factors. The existing data can not be used to establish if either test is truly separating on the basis of modality since there is no standard for comparison. To establish if either test has correctly measured modality or if both tests have measured a portion of modality will require other tests for comparison.

Research Implications

Implications for further research are readily apparent. The only significant finding is that the Questionnaire on Vividness of Mental Imagery and the Modality Index separate factors which are based on their

modality subtests, indicating these two tests should now be checked for consistency and reliability against intelligence or personality tests of known characteristics. If consistent results can be established, one or both tests may be able to demonstrate an ability to separate on the basis of modality and could then be used for further research into the nature of modalities.

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APPENDIX

Instructional Guide

and

Sample Instruments

Instructional Guide

For the administering of:

Verbalizer-Visualizer Quiz
Modality Index
Questionaire on Vividness of Mental Imagery
Representational System Bias Test

Tests of visual, auditory and kinesthetic modality

Test time approximately one hour

For information contact:

Brian Miles
11576-140 Street
Edmonton, Alberta
T5M 1S7

454-0947

Check list:

To do these tests you will require the following materials.

1. Instructional Guide
2. Verbalizer-Visualizer Quiz
3. Modality Index
4. Feely bags
5. Questionnaire on Vividness of Mental Imagery
6. Representational System Bias Test
7. Background Profile
8. Answer Sheets

Testing Technique:

Note: Each of these tests requires some self reflection and is best done under conditions of quiet, with ample time to finish without rushing. Total time approximately 1 hour.

Distracter Comments: This guide includes a number of pages of comments which can be read during the required 1 minute between the test task and the recording of the answers. The exact comments are unimportant, however the distraction from any method of maintaining the task in short term memory is important. Read in a slow deliberate fashion and most of the distracter comments will take the entire 1 minute before the answers are written down. Your own comments and observations are likely as good, if they take up 1 minute.

Verbalizer-Visualizer Quiz: This test requires the allowed reading time be fairly close to 10 seconds, but more important each person be able to easily read the list without strain and without moving the list while others are trying to read. The distracter comments following the

presentation should occupy 1 minute, and be meaningful enough to draw peoples attention from the actively remembering the list.

Modality Index: This test requires the limiting of the visual, auditory and kinesthetic observation times to 10 seconds, 3 readings and 2 minutes respectively, however it is again important that the distracters assure recall from other then short term memory. The order of the matrix 1-9 is important and should be emphasized, assuring that a person with the ability to recall the exact order of the items can record it. The reading list should be read in order, with no commentary, numbering or verbal emphasis by the reader.

Representational System Bias Test: This test requires no preamble and can be done in any context, with or without preconditioning. It is useful to point out that the numbers 1, 2 and 3 must all be used, and each question should have only one of each number.

Questionnaire on Vividness of Mental Imagery: This

questionnaire will require extra time as people will have to learn to give an assessment to their images. It might be best to emphasis that image is equivalent to representation.

Answer Sheet: The answer sheet should be handed out after everyone has started on the Questionnaire on Vividness of Mental Imagery, as this will assure that people will have no indication of what a 'right' answer is. Emphasis the writing of the scores on the front of each exam.

Suggested Time Line:

Read preamble	
Hand out Verbalizer-Visualizer Quiz	
Display 'touch nose sign'	
Display visual list	(10 seconds)
Read distracter comments	(1 minute)
Display auditory list	(10 seconds)
Read distracter comments	(1 minute)
Display kinesthetic list	(10 seconds)
Read distracter comments	(1 minute)
Hand out Modality Index	
Display picture	(10 seconds)
Read distracter comments	(1 minute)
Read 'reading list'	(3 times)
Read distracter comments	(1 minute)
Hand out 'feely bags"	(2 minutes)
Read distracter comments	(1 minute)
Hand out Questionnaire of Vividness of Mental Imagery and Representational System Bias Test	(10-15 minutes)
Hand out Answer Sheet	
Collect scored tests	

Distracter comments:

**These comments may be used as you wish, however some of the cautions and the use of distraction during the minute wait are surely needed. If you read these pages aloud and follow the instructions you will find the total test should "just happen'. Reading slowly and deliberatly will result in about the required 1 minute between test sections.*

The purpose of the following series of tests is to try establish your preferred modality for sensing and modeling the world. A modality is basically one of the five senses, visual, auditory, kinesthetic (feeling), olfactory (smell) and gustatory (taste). Our interest is the manner in which preference for one modality or the other might effect the memory or learning. The existence of a preferred modality could have implications for development of instructional methods which enhance the learning for students with modality preferences. The comment earlier about modeling the world refers to the remembering and interpreting of memory which is enhanced or deminished by the introduction of a preference for one or more modalities. This study only examines three modalities, visual, auditory and kinesthetic.

Each of the three tests which you will be doing will be composed of three subtests which are intended to test your

Verbalizer-Visualizer Quiz

This test will require you to remember and recall three lists of words.You will be allowed 10 seconds to read each list, then will wait 1 minute before writing down the portion of the list which you can rec Each list has a characteristic modality or sense and it might be easier to remember the list in terms of the dominant modality (ie visual, auditory, kinesthetic).

*Enter scores after scoring:

Visual	Auditory	Kinesthetic
_____	_____	_____

Visual word list:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

Auditory word list:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Kinesthetic word list:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

If you can read this place your finger on your nose. The print will be this size and you must be able to read it.

Thank-you

ability to function in each of the main modalities. You might find there is a 'best way' for you to do any of the tasks you are assigned and this 'best way' may be to use the modality in the test. If you find this uncomfortable you are welcome to use any technique which you are comfortable with. However our endeavor is to measure something related to long term memory and the constant repetition of the items to maintain them in short term memory was not our intent.

The time between the subtests will have some readings and comments by the tester to establish the conditions for the next portion of the test. Please listen to the material between tests as it is also part of the test.

**Hand out Verbalizer-Visualizer Quiz*

The first test is based on the work of a cognitive theorist Paul Pavio and gives us an indication of the manner in which words can be involved in modalities. You will be allowed about ten seconds to examine and commit to memory a list of ten words. Please be sure you can easily read the print on the display as we do not intend to test your eyes.

**Show the touch nose display and be sure everyone can read the lists.*

Visual List

book
chair
mountain
window
car
tree
table
hat
door
dog

**Display visual word list for ten seconds.*

The word list which you have just seen is considered to be composed of 'concrete word' which in lingustic terms are largely words with a pictorial content and are considered to elicit an image in the minds eye. Pavio's studies indicated the ability to associate a word with a picture made the recall easier. This idea explains to some degree the mnemonic memory methods which use a series of nonsence pictures in association with the desired series of items which are being committed to memory. (one a bun, two a shoe, three a tree, four a door, etc) The basis for using these words on this list is that those of you with a well developed visual modality should be able to best retain the word list and the pictorial representation. The possibility exists that you may be able to simply recall the image of the page and this two would be considered an indication of a well developed visual modality.

**After about 1 minute ask everyone to write down the portion of the list which they can remember.*

Auditory list

thunder
screech
laugh
bark
music
clatter
jingle
gurgle
crack
toot

**Display the auditory list for 10 seconds.*

As you are now aware the nature of this word list is quite different from the previous list. These are words which are considered to be 'abstract' as they do not necessarily have directly associated pictures. In Pavio's original work these were usually words like truth. justice, health or nonsence words. The argument for using this auditory list of words is that Pavio's associate Richardson discovered that people who were blind from birth responded to auditory word in a manner similar to the response of the sighted to visual word lists. An auditory oriented person could replicate the sounds directly in memory, as opposed to producing a picture which represented the sound. It appears that indirect representations are subject greater error in retrieval, possibly as a result of a required interpretation from one modality to the other. We assume that anyone with a well developed auditory modality will represent the words directly in sound, rather than associating a visual representation of the sound happening and should be more easily remember the list.

**After 1 minute ask everyone to write down the portion of the list which they remember.*

Kinesthetic list

sorrow

silky

pain

grooved

soft

tired

sharp

cold

anger

rough

**Allow 10 seconds to read the kinesthetic word list.*

You will likely notice this last list has a distinctive feel to it. The work of Pavio and Richardson did not include the concept of 'feeling' words, but we felt it might be possible to test the ability of some people to directly represent the words in their 'physical memory'. In each case we are dealing with the difference between the direct memory of the meaning of a word. as opposed to the indirect memory by association to another modality. The kinesthetic modality likely more prevalent in physical activities, things we often do not speak about and may rarely see, for example how it feels to scratch your back or exactly how you appear when walking.

We are assuming that the existence of a superior kinesthetic memory might be an indication of a preference for that modality. We are also aware that the possibility exists that you are very good at using association between the word and some other modalities representation of it as opposed to any true preference for the modality we are testing.

**After about 1 minute ask everyone to write down the portion of the word list which they remember.*

Modality Index

This test will require you to see, hear, and feel patterns of pictures, words, and tactile objects and recall these items after a sufficient interval of time has passed to assure the use of long term memory.

The first portion of this test will require you to observe a 3 by 3 matrix of pictures for 10 seconds and recall them after 1 minute. The check list shows the pictures and names of each shape, enter a check for the existance and the position number if the exact position in the matrix is recalled. The matrix is numbered in the sequence shown above. A word list will be read to you and a 'feely bag' used to test the auditory and kinesthetic modalities.

1	2	3
4	5	6
7	8	9

*Enter scores after scoring:

Visual	Auditory	Kinesthetic
_____	_____	_____

List items from "Visual shapes matrix".

		Exists	Position#
STAR		_____	_____
PEAR		_____	_____
CIRCLE		_____	_____
CAT		_____	_____
BOOT		_____	_____
ARROW		_____	_____
SQUARE		_____	_____
HAT		_____	_____
MOON		_____	_____
CUP		_____	_____
APPLE		_____	_____
RABBIT		_____	_____
TEAPOT		_____	_____
TRIANGLE		_____	_____
PLUS		_____	_____

List items from the "Reading List".

		Exists	Position#
STAR			
PEAR			
CIRCLE			
CAT			
BOOT			
ARROW			
SQUARE			
HAT			
MOON			
CUP			
APPLE			
RABBIT			
TEAPOT			
TRIANGLE			
PLUS			

List forms after using "Feely Bag".

		Exists	Position#
STAR			
PEAR			
CIRCLE			
CAT			
BOOT			
ARROW			
SQUARE			
HAT			
MOON			
CUP			
APPLE			
RABBIT			
TEAPOT			
TRIANGLE			
PLUS			

In the Modality Index you will be trying to recall pictures, names or the feel of a series of standard shapes, in addition to paying attention to the information between activities. This test will try to access directly the manner in which you are able to represent the world in a given modality. The activities are aimed directly at a visualization, auditory recall and tactile memory of manipulated shapes. The intent is that you try remember if each item exists and if you can remember the exact numbered position in the matrix or the exact order in the word list read to you.

**Hand out Modality Index.*

Visual shapes matrix

**Display picture matrix for 10 seconds.*

Notice your response to the concrete images as opposed to the word lists given to you on the previous test. The endeavor here is to get at the modalities in the most direct fashion possible. A test similar to this is currently in use with the Edmonton and Calgary school boards as a method of assessment for children experiencing learning difficulties. We have modified portions of the test in an attempt to improve the use in mass testing, rather then a one-on-one which would be very time consuming.

Where Pavio assumed there was a 'dual coding model' involving representations in pictures and words, this test is assuming some direct representation in the modality involved. This test may be a more realistic method of testing mental imagery as it requires the remembering an actual images, which may have no specific name associated with them. The question that arises is could you remember pictures of things which you have no name for? Obviously "yes", or you could never recognize anything if you saw it for a second time.

**After about 1 minute ask everyone to check the existence and position of all images that they can remember.*

Reading list

star
teapot
plus
cat
pear
cup
apple
hat
circle

**Read the 'reading list' 3 times, with no 'ands', 'ahs' or emphasis on any portion of the list.*

It is likely apparent that your response to the list of words you just heard is some what different from the pictures in the visual portion of the test. In addition the act of listening to this talk between hearing and recall is different then having seen a list of auditory words. The idea of testing directly the modality strength has the advantage that the response to the words has to at least start in the modality being tested. Some people may still be doing conversions to some other modality, but there is no control to stop this. In the next portion of the test you will be asked to identify the shapes by feeling them, without actually being able to see them. We recognize that the current talking which is going on will likely be more of a problem for auditory people, since it impinges directly on the modality in which they are representing the readings. The possiblity exists that none of you are auditory, since part of this study is to examine weather or not modalities can be tested for.

**After about 1 minute ask everyone to check the existence and position of all words that they can remember.*

Kinesthetic Shapes

These are the sandpaper cutouts hidden in the 9 x 12 envelope

**Allow about 2 minutes for the feely bag exploration, and comment 'No Peeking'.*

Notice how unfamiliar the action of identifying anything by feel is. The memory of the exact feel of the items is what we would like to test, what we may be testing is your ability to convert the original feelings to equivalent pictures or words. Another problem we may encounter is tactile ability and kinesthetic representation may not be directly related.

Possibly you noted how totally unfamiliar the shape was until you could label it. If you move your hand about in a manner similar to the process you used when feeling in the bag may recall the position and feel of each shape, whether or not you can give it a name. The original test used many moveable shapes laid out in a matrix, and asks to have another set of shapes moved into the exact same order. This likely is more representative of a truely kinesthetic memory. However our endeavor is to produce a test procedure which can be used in large groups, rather then one-to-one.

**After about 1 minute ask everyone to check the existence and position of all the shapes they can remember.*

Questionnaire on Vividness of Mental Imagery

You are to rate the vividness of your imagery by reference to the rating scale shown. For example, if your image is "vague and dim" you give a rating of 3. You might find it helpfull to go through all ten assessments before starting to give values to the vividness you encounter.

The image aroused by an item of this test may be:

Perfectly clear and as vivid as the real experience	Rating 7
Very clear and comparable in vividness to the actual experience.	Rating 6
Moderatly clear and vivid	Rating 5
Not clear or vivid, but recognizable.	Rating 4
Vauge and dim	Rating 3
So vaugue and dim as to be hardly disernible	Rating 2
No image present at all, you only 'knowing' that you are thinking of the object.	Rating 1

***Enter scores after scoring:**

Visual **Auditory** **Kinesthetic**

Perfectly clear and as vivid as the real experience	Rating 7
Very clear and comparable in vividness to the actual experience.	Rating 6
Moderatly clear and vivid	Rating 5
Not clear or vivid, but recognizable.	Rating 4
Vauge and dim	Rating 3
So vaugue and dim as to be hardly disernible	Rating 2
No image present at all, you only 'knowing' that you are thinking of the object.	Rating 1

Think of some relative or friend whom you frequently see, considering carefully the picture which rises before your "mind's eye".

1. The exact contour of face, head and shoulders ( )
2. Characteristic poses of head or body ( )
3. The length of step, movment of body or hands ( )
4. The different colours in some familiar outfit ( )
5. Their presence in some familiar location ( )
6. The sun sinking below the horizon ( )
7. The opening scene from a TV show or movie ( )
8. The appearance of your bedroom ( )
9. The appearance of a familiar page of print ( )
10. The appearance of your own foot ( )

Perfectly clear and as vivid as the real experience	Rating 7
Very clear and comparable in vividness to the actual experience.	Rating 6
Moderatly clear and vivid	Rating 5
Not clear or vivid, but recognizable.	Rating 4
Vauge and dim	Rating 3
So vaugue and dim as to be hardly disernible	Rating 2
No image present at all, you only 'knowing' that you are thinking of the object.	Rating 1

Think of each of the following sounds, considering carefully the image which comes to your "mind's ear".

1. A car horn ( )
2. The mewing of a cat ( )
3. The clapping of hands in applause ( )
4. Some musical instrument ( )
5. Running footsteps ( )
6. A slamming door ( )
7. The theme music from some show or movie ( )
8. The wind blowing ( )
9. The sounds at a construction site ( )
10. The sound of running water ( )

Perfectly clear and as vivid as the real experience	Rating 7
Very clear and comparable in vividness to the actual experience.	Rating 6
Moderatly clear and vivid	Rating 5
Not clear or vivid, but recognizable.	Rating 4
Vauge and dim	Rating 3
So vaugue and dim as to be hardly disernible	Rating 2
No image present at all, you only 'knowing' that you are thinking of the object.	Rating 1

Think of "feeling" or touching each of the following, consider carefully the image which comes to your "mind's touch".

1. Sand ( )
2. Linen ( )
3. Fur ( )
4. The prick of a pin or needle ( )
5. A warm bath ( )
6. Running up stairs ( )
7. Reaching onto a high shelf ( )
8. A strong wind ( )
9. Your legs after a long walk ( )
10. A paper cut ( )

Representational System Bias Test

For each of the statements on the following pages rank the phrases with a 3, 2, or 1.

3 for the phrase best describing you
2 for the phrase next best describing you
1 for the phrase least describing you

NB: Use each # once.

EXAMPLE:
If I was to respond to a sample question or statement:

I would most often chose responce A. 3
I would least often chose responce B. 1
I would put down a #2 for responce C. 2

*Enter scores after scoring:

Visual	Auditory	Kinesthetic
_____	_____	_____

1. I make important decisions based on:
   - What looks best to me. ____
   - Which way sounds best. ____
   - Gut level feelings. ____

2. During an argument I am most influenced by:
   - Seeing the other persons point of view. ____
   - Hearing the other persons tone of voice. ____
   - Being touched by another persons feelings. ____

3. I most easily communicate what is going on with me by:
   - The way I dress. ____
   - My tone of voice. ____
   - The feelings I share. ____

4. It is easy for me to:
   - Select rich color combinations: ____
   - Find ideal volume and tuning on a stereo. ____
   - Select a comfortable place to sit or rest. ____

5. I find:
   - I respond to the way a room looks. ____
   - I am atuned to sounds around me. ____
   - I am sensitive to the way clothing feels. ____

6. When I become confused (ie during a lecture).

I don't see whats going on. ____
I don't understand what is being said. ____
I don't have a feel for the material. ____

7. I have a significant memory which is easy to recall and:

I remember the scene like it was today. ____
I remember what was said and how. ____
I remember the emotion and how I felt . ____

8. When I plan my future and think how things will one day be:

I can see just what will happen. ____
I can tell just how things will be. ____
I have a feel for how things will work out. ____

9. When I am at a horror movie.

I am bothered by what I see. ____
I am bothered by the sounds and the music. ____
I am bothered by the feelings I experience. ____

10. On a carnival ride (ie roller coaster, merry-go-round).

I am aware of the scene rushing past me. ____
I am aware of the noise and confusion. ____
I am aware of the speed and motion. ____

Background Profile

1. I understand my participation in this project is voluntary.
2. I understand my anonymity is assured.
3. I understand I will have access to the results of all tests.
4. I understand I will have the opportunity to discuss the results with the reseacher.
5. I understand the results may be used for research and publication with my anonymity assured.

Signed: _____

NB: Thank-you very much for your time and consideration.

Age:_____ Sex: (MALE) (FEMALE)

How many children did your parents have:

(1)(2)(3)(4)(5)(6)(7)(8)(9)(10)

Which child where you

(1)(2)(3)(4)(5)(6)(7)(8)(9)(10)

Has there been a death in this family (YES)(NO)

Have you lived with only one parent (YES)(NO)

Did your family attend church (YES)(NO)

Do you attend church (YES)(NO)

Is english your native tongue (YES)(NO)

How many languages can you speak (1)(2)(3)(4)

**Circle the bracketed words which best describe you:*

Do you have better grades in the area of: (English and Social Studies), (Math and Science) or (Equal Success).

Did you ever have trouble or poor success in the areas of (english), (social studies), (math), (physics), (chemistry), (foreign language)

Can you easily program a computer (yes)(no)

Do you play a musical instrument (yes)(no)

Do you (paint, draw), or (sculpt) (yes)(no)

Do play in any organized sport (yes)(no)

Can you balance a check book (yes)(no)

Can you drive a car (yes)(no)

Do you live with:

(parents), (alone), (others), (spouse).

Do you have children of your own (yes)(no)

How many children (1)(2)(3)(4)(5)(6)

Have you worked part time (yes)(no)

Have you worked full time (yes)(no)

Have you been self supporting (yes)(no)

Have you suffered a major illness (yes)(no)

Have you suffered a major injury (yes)(no)

Before taking these tests would you have believed yourself to be:

(visual) (auditory) (kinesthetic) (?)

After taking these test would you believe yourself to be:

(visual) (auditory) (kinesthetic) (?)

Which test taught you most about yourself:

(VVQ) (MI) (QVMI) (RSBT) (?)

Which portion of the test:

(visual) (auditory) (kinesthetic) (?)

Which test gave you most difficulty:

(VVQ) (MI) (QVMI) (RSBT) (?)

Which portion of the test:

(visual) (auditory) (kinesthetic) (?)

Did any test seem to test something other than what it intended:

(VVQ) (MI) (QVMI) (RSBT) (?)

Which portion of the test:

(visual) (auditory) (kinesthetic) (?)

**Hand out Questionnaire on Vividness of Mental Imagery, Representational System Bias Test and Background Profile.*

The next tests require you do a little introspection. We suggest you read each section or question completely and then decide how highly you value any given statement or memory with respect to your other answers. The first reaction is often very representative of how people believe themselves to be.

Please note, in each test a high number higher value. In the Vividness of Mental Imagery Questionnaire the seven is most like reality. In the Representational System Bias Test the three is most like you. The Representational System Bias Test requires each number one to three be used for each question. The distinction between your preferences is sometimes hard to make, but please rate one, two and three no matter how small you believe the difference to be.

Please, take a moment to see that your name and student number appears on all the pages of these exams and the background profile.

**Hand out Answer Sheet last and endeavor to see that everyone returns all exams in a bundle, possibly inserted into the background Profile. The exams will be sorted later, when we are sure they are named. and numbered.*

Answer sheet

Verbalizer-Visualizer Quiz

book	thunder	sorrow
chair	screech	silky
mountain	laugh	pain
window	bark	grooved
car	music	soft
tree	clatter	tired
table	jingle	sharp
hat	gurgle	cold
door	crack	anger
dog	toot	rough

_____ _____ _____Totals

Modality Index

(existance and position each get a mark)

	Picture	Reading List	Feely Bag
1	circle	star	cat
2	cat	teapot	arrow
3	hat	plus	cup
4	moon	cat	moon
5	arrow	pear	pear
6	cup	cup	triangle
7	plus	apple	hat
8	triangle	hat	plus
9	pear	circle	circle

_____ _____ _____Totals

Questionnaire on Vividness of Mental Imagery

Simple sum the numbers for each scale to get an indication of the modality for which you have the most vivid imagery.

Visual Auditory Kinesthetic

_____ _____ _____Totals

Representational System Bias Test

Add up the totals for all responce 'A', this is your visual score. Totals for responce 'B' are auditory and responce 'C' is kinesthetic.

Visual Auditory Kinesthetic

_____ _____ _____Totals

****

Please note your scores on the front of the appropriate exams. We will try have a set of 'averages' with in the week, to give you some idea of the high or low scores. Your time and involvement has been greatly appreciated.

Thank-you

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